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On the interpretation of low-latitude hydrological proxy records based on Maunder Minimum AOGCM simulations

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An increasing number of proxy records, which are related to changes in the hydrological cycle, have been collected for climate reconstructions of the last millennium. There has been, however, little attempt to test climate models with such proxy records or to interpret proxy records using climate model simulations. In the present study, we investigate hydrological changes between three different types of experiments: a present-day control, a perpetual AD 1640, and an ensemble of six transient Maunder Minimum (AD 1640-1715) simulations. Atmospheric moisture transport is analyzed in terms of contributions of specific humidity and circulation changes, in particular the importance of the specific humidity contribution to changes in moisture transport. As an example, the moisture budget of the western tropical Pacific is investigated to aid the interpretation of a proxy record in this specific region: The present-day freshening of the western tropical Pacific, compared with the Maunder Minimum, is explained by the increased zonal moisture transport via trade winds, mainly due to the increased amount of atmospheric water vapor content in the warming world. Due to the existence of several uncertainty factors, such as forcing reconstruction, the link between the model simulations and proxy records is, however, not definitive. Nevertheless, the thermal contribution to hydrological proxy records is important and not limited to the Maunder Minimum period.